

Activity #12: Math How Tall is the School Building? Angle of Elevation Project (Teacher version)

Note to students: Lab teams of two or three students are required for this activity.

National Standards addressed:

Content Standards:

Number and Operations Expectation: Students will compute fluently and make reasonable estimates.

Algebra Expectation: Students will represent and analyze mathematical situations and structures using algebraic symbols.

Geometry Expectation: Students will use visualization, spatial reasoning, and geometric modeling to solve problems.

Measurement Expectations: Students will make decisions about units and scales that are appropriate for problem situations involving measurement; students will analyze precision, accuracy, and approximate error in measurement situations.

Data Analysis and Probability Expectation: Students will select and use appropriate statistical methods to analyze data.

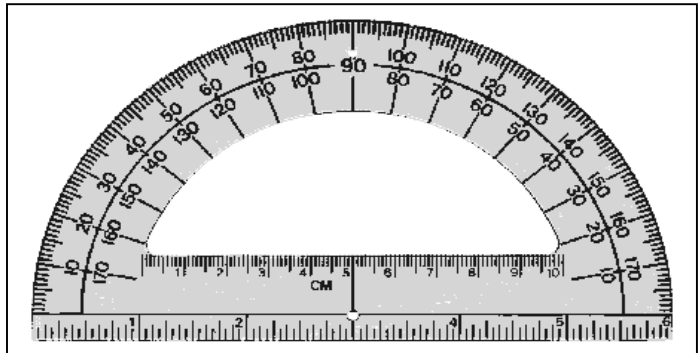
Process Standards:

Problem Solving Expectation: Students will monitor and reflect on the process of mathematical problem solving.

Communication Expectations: Students will organize and consolidate their mathematical thinking through communication; students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Purpose:

- To construct a hypsometer
- To use right triangle trigonometry
- To use indirect measurement to determine vertical height
- To establish best estimate of building's height
- To find the mean of gathered data
- To construct box and whisker plot on TI graphing calculator



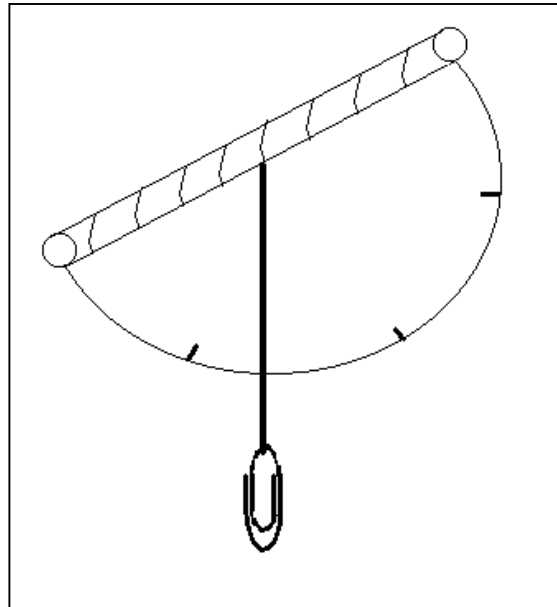
Materials: protractor, straw, string, paper clip, tape, 50-foot tape measure, TI graphing calculator

Activity Procedure:

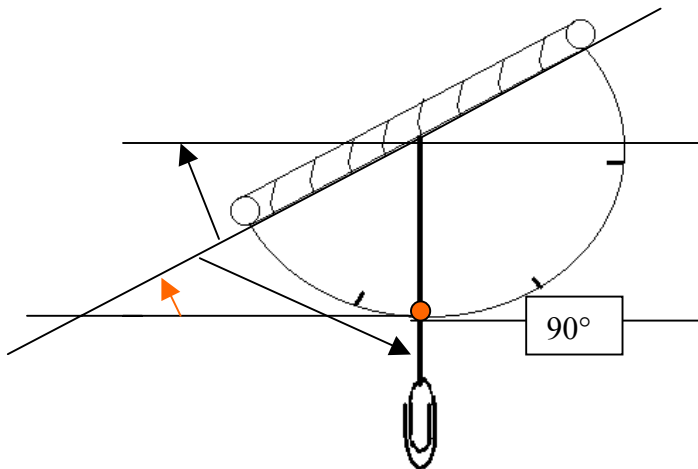
1. Construct hypsometer.

See diagram.

- a. Attach straw to straight edge of protractor.
- b. Tie length of string about 12" long to the center of the protractor's straight edge.
- c. Attach paper clip to end of string. String must dangle freely.



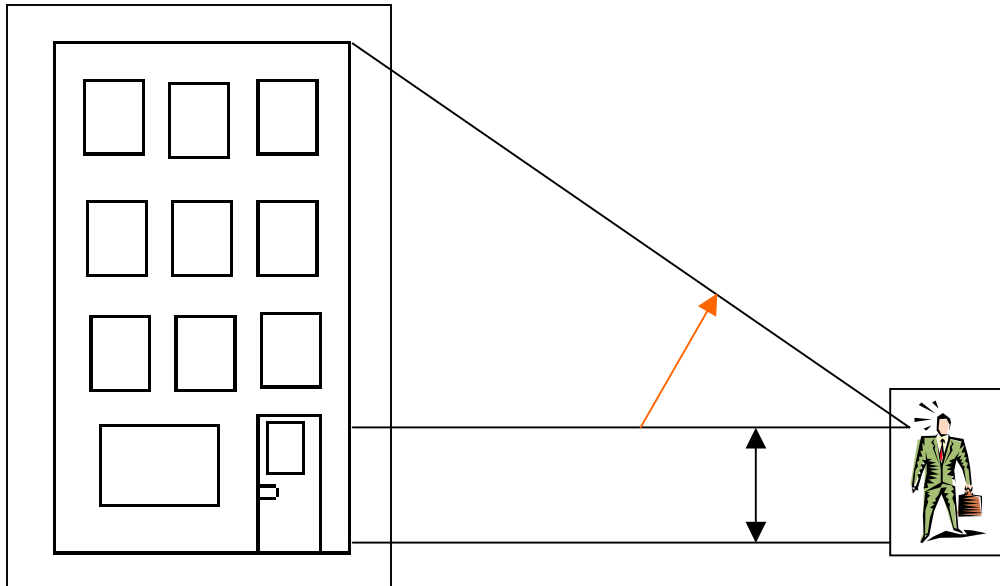
2. Discuss the use of the hypsometer to find the angle of elevation.



As you look up to the top of your school building, the angle indicated by the red arrow is the angle of elevation. If you read the degree measure on the protractor at the point where the string dangles (red dot), how would you determine the angle of elevation?

(Students find that the complement is the angle measurement for elevation.)

3. Draw a picture of yourself, outside with your hypsometer looking up at the top of the school building. Look for any angles and/or distances for which you know or could determine by direct measurement.



(Students find directly the angle of elevation , the distance from the school building, and their own height. Students must use the appropriate right triangle trig to find the opposite side of the right triangle and then add their own “height” to approximate the height of the building.)

4. Students go outside as a class to gather needed information to finish the activity. Show your work and circle what you determined to be the height of your school building.

Analysis and Extension:

1. Each team writes their building height on the board. Discuss discrepancies and why these might have occurred. What happened? _____

2. Determine “the class estimate” of the height of the school building from the gathered data. Show or explain this number.

3. Create a box and whisker plot using the TI graphing calculator. Find mean from plot. Print the plot using the TI Graphlink.

(Discussion of outliers will make the data gathered make more sense. Students can find the mean of the building heights. By making a box and whisker plot on the TI graphing calculator, outliers and the mean become more “apparent”.)

The following web sites and articles provide enrichment and support for this activity:

1. GEOMETRY AN INTEGRATED APPROACH, by Larson, Boswell, Stiff, D. C. Heath and Company ©1995.

2. Visit To A Tiny Planet, Near Collision, NASA, NASA explores, www.NASAexplores.com

3. http://bellnetweb.brc.tamus.edu/res_grid/meamath.htm

4. <http://www.ncforestry.org/docs/Resource%20Materials/Tree%20Measurement.PDF>